



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/584,947	09/25/2006	Naoki Komatsu	Q95745	2460
23373 7590 12/02/2008 SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037			EXAMINER BARCENA, CARLOS	
			ART UNIT 4181	PAPER NUMBER
			MAIL DATE 12/02/2008	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/584,947

Applicant(s)

KOMATSU ET AL.

Examiner

Carlos Barcena

Art Unit

4181

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 11-20 is/are pending in the application.
- 4a) Of the above claim(s) 18 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 11-17 and 19 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-850)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date See Continuation Sheet

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :25 September 2006; 05 July 2006.

DETAILED ACTION

Claims 11-20 are subject to restriction for application 10/584947 (Attorney Docket No. Q95745).

Claims 11-17 and 19 are presented for examination based on the merit.

Election/Restrictions

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claims 11-17 and 19, drawn to a method of purifying carbon nanotubes using a template.

Group II, claim 18, drawn to carbon nanotube, wherein the metal element that can be coordinated in a porphyrin skeleton is carried on the surface.

Group III, claim 20, drawn to carbon nanotube wherein a half width of a peak appearing near a spectrum of 200 cm^{-1} obtained by a Raman scattering measurement is equal to or smaller than 20 cm^{-1} .

The inventions listed as Groups I, II, and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons. The express "special technical features" is defined as meaning those technical features that define a contribution which each of the inventions, considered as a whole, makes over the prior art."(Rule 13.2). Unity exists only when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding claimed special technical features. In this case, the technical feature shared by

each invention is carbon nanotube. The question of unity of invention has been reconsidered retroactively by the examiner in view of a general search makes clear that the inventions of the groups I, II, and III lack the same or corresponding special technical because the claimed technical feature does not define a contribution which each of the inventions, considered as a whole, makes over the prior art (no single general inventive concept is the same with respect to all three groups).

2. During a telephone conversation made by Examiner Jared Wood with Allen Casper on 10/10/2008 a provisional election was made to prosecute the invention of Group I, claims 11-17 and 19. Affirmation of this election must be made by applicant in replying to this Office action. Claims 18 and 20 are withdrawn from further consideration by the current examiner (Carlos Barcena), 37 CFR 1.142(b), as being drawn to a non-elected invention.

3. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

4. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and the product claims are subsequently found allowable, withdrawn process claims that depend from or otherwise require all the limitations of the allowable product claim will be considered for rejoinder. All claims directed to a nonelected process invention must require all the limitations of an allowable product claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product are found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product claim will not be rejoined. See MPEP § 821.04(b). Additionally, in order to retain the right to rejoinder in accordance with the above policy, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product claims. **Failure to do so may result in a loss of the right to rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Specification

5. The disclosure is objected to because of the following informalities. "Asides" (p. 4, para. [0006], line 9) should be changed to "aside" and "dispensable" (p. 6, para. [0009], lines 13) should be changed to "indispensable". Appropriate correction is required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

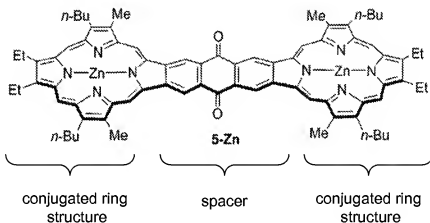
8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. **Claims 11-17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dalton *et al.* (A functional conjugated polymer to process, purify and selectively interact with single wall carbon nanotubes) in view of Uno *et al.* (Hexagonal columnar porphyrin assembly by unique trimeric complexation of a porphyrin dimer with π - π stacking; remarkable thermal behavior in a solid).**

Regarding applicant claim 11-13, 16, 17, and 19, Dalton teaches solutions of semi-conjugated polymer are capable of suspending single wall carbon nanotubes indefinitely whilst the accompanying amorphous graphite settles out. Moreover, Raman spectrometry indicates that the polymer (template compound) interacts with the nanotubes of specific diameter or range of

diameter (abstract). Dalton teaches sonicating the hybrid suspension (to dissolve the nanotubes), decanting the resulting suspension (to extract and recover specific carbon nanotubes from the solution) (p. 1217, Section 2, Experimental). Dalton does not teach the template compound to consist of a plurality of receptor regions each including a conjugated ring structure and a spacer region that fixes the receptor regions.

Uno teaches a well-defined, highly ordered supramolecular systems containing a structure as recited in claim 11 or 12 with a conjugated ring structure and a spacer region including an oleophilic subsistent (*n*-Bu) (Scheme 1 or 2). Also see below.



It would have been obvious to one of ordinary skill in the art at the time of invention to size select carbon nanotubes with similar diameters using a conjugated polymer or template compound that wrap around or interact and solubilize the carbon nanotube including conjugated porphyrin systems.

One would be motivated to substitute one system for another because separation or purification agents are those that have a planar orientation (i.e., the porphyrin structure), π -electrons (any conjugated system) available for association with the surface of the nanotubes,

and which also include a soluble portion of the molecule. Dalton states it appears that the polymer interacts strongly with nanotubes with in a specified diameter range and weakly with tubes of smaller and higher diameters, but also states the exact nature of the polymer interaction with the carbon nanotubes is unclear (Dalton, p. 1218, lines 2-8). Carbon nanotubes themselves can be considered conjugated macromolecules with nanotube surface properties conceptually similar to those of the porphyrin assembly, thus amenable to π - π stacking in porphyrin (Uno, p. 12082, lines 13-16) thus allowing for the size selection.

Regarding applicant claim 14, Dalton does not expressly state recovery including centrifugation, but does use gravimetric sedimentation over the course several days which accomplishes the same end means (p. 1217, Section 2, Experimental).

Regarding applicant claim 15, Dalton does not expressly state using tetrahydrofuran, but does use toluene. Uno uses chlorinated solvents (i.e., chloroform). Any solvent which solubilizes both the carbon nanotubes and the template compound is appropriate. See MPEP 2143 Section B (Simple Substitution of One Known Element for Another To Obtain Predictable Results).

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. E. Gregan et al. (Purification and isolation of SWNTs, Carbon 2004, 1031-1035) discloses improved solubility and diameter size selection for carbon nanotubes using conjugated systems.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carlos Barcena whose telephone number is (571) 270-5780. The examiner can normally be reached on Monday through Thursday 8AM - 5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571) 272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHAEL MARCHESCHI/
Primary Examiner, Art Unit 1793

/C. B./
Examiner, Art Unit 4181